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NOSC METROLOGY LABORATORY: CAPABILITIES SUMMARY.(U)
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6 # NOSC METROLOGY LABORATORY: CAPABILITIES SUMMARY.

Product Assurance Division (Code 931)
Product Engineering Department (Code 93)

11 March 1979

12 22p.

NAVAL OCEAN SYSTEMS CENTER
SAN DIEGO, CALIFORNIA 92152

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CA 92152

AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

RR GAVAZZI, CAPT USN
Commander

HL BLOOD
Technical Director

ADMINISTRATIVE INFORMATION

Implicit in the Naval Ocean Systems Center's research, development, test, evaluation, production, and life-cycle support mission is the requirement to maintain the capability to verify the acceptability of its products, whether for preliminary concept evaluation or for establishing the suitability of an item of equipment for Fleet use. To meet this requirement, the Center has developed its highly specialized Metrology Laboratory. Specifically, the Metrology Laboratory measures various components for features of size, form, and finish to a high degree of precision. The Laboratory is equipped with extensive standard and special measuring tools and machines to perform virtually any mechanical size and feature measurement task.

The mechanical measurement services of the Metrology Laboratory, operated under the Product Assurance Division, Code 931, are available to any Center project requiring such aid. Services may be obtained by contacting Code 93122.

The purpose of this NOSC-funded document is to provide a summary of the Metrology Laboratory's equipment and capabilities. Since the Laboratory has more than 1000 pieces of measuring and inspection equipment, emphasis will be on the more unique devices available. Because this document is intended for internal NOSC use, no DD form 1473 is provided.

EJ Thirkill
Head, Product Assurance Division

DP Newman
Head, Product Engineering Department

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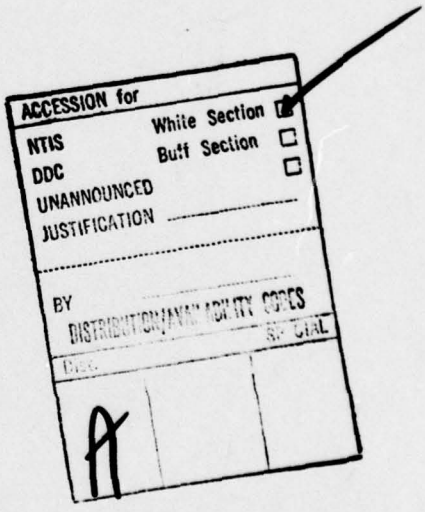


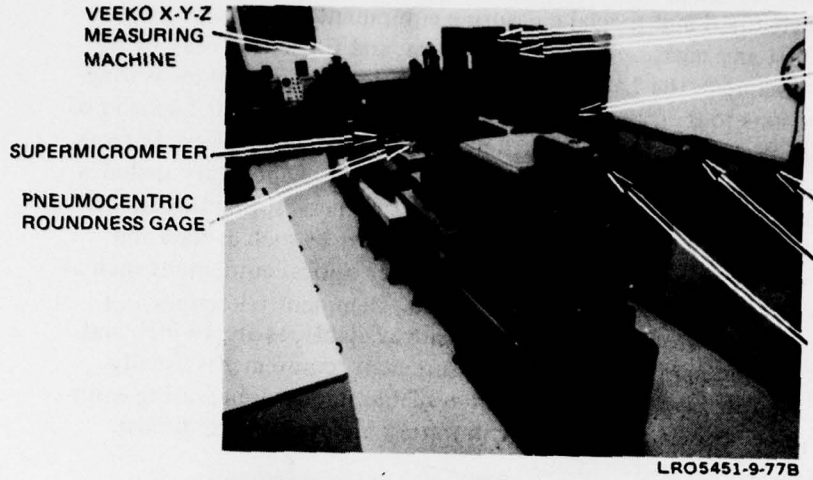
CAPABILITIES SUMMARY

The Naval Ocean Systems Center's Metrology Laboratory, operated by the Product Assurance Division, Code 931, is located in building 128, rooms 142 and 143, Bayside. The Laboratory, with more than 1000 pieces of precision standard and special measuring equipment, is well equipped to perform almost any measurement of size, form, and finish that may be required. For example, the Laboratory has the basic capability of measuring linear dimensions to 0.000002 inch and angular dimensions to 0.1 second of arc. In addition, features of form such as roundness, concentricity, flatness, perpendicularity, and parallelism can be checked. The Laboratory includes instruments to measure surface finish, material hardness, spring forces, and deflection. Also included are optical measuring devices such as flats and squares, as well as an optical dividing head. Other optical equipment such as reflection mirrors, microscopes, optical targets, alignment telescopes, collimators, and monochromatic light sources are available, as are 14-inch and 30-inch optical comparators. Special measurement requirements usually can be met by utilizing a combination of available standard measuring equipment. Personnel associated with the Laboratory are available to discuss unusual measurement requirements.

The equipment in the Laboratory is maintained in calibration by skilled personnel who utilize reference standards traceable to the National Bureau of Standards.

GENERAL ARRANGEMENT

The illustrations show the general arrangement of the Metrology Laboratory. Building 128, rooms 142 and 143, Bayside.



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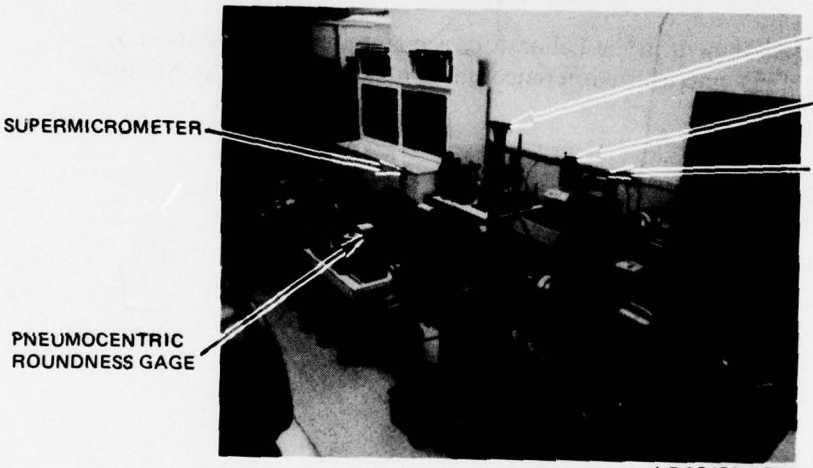

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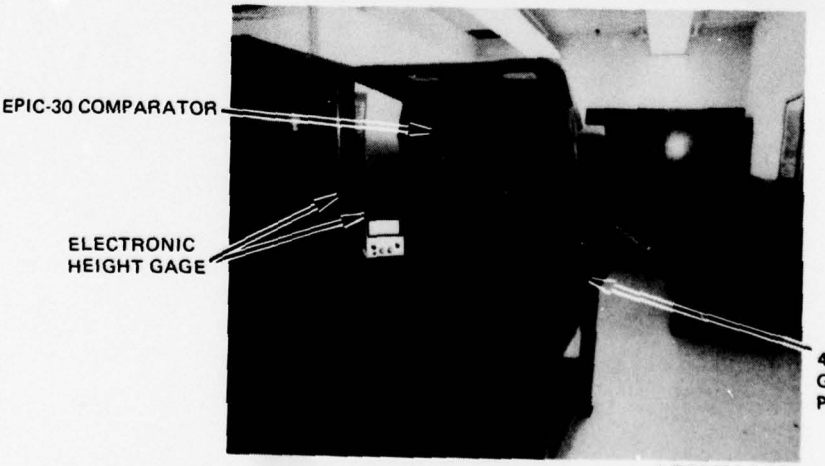

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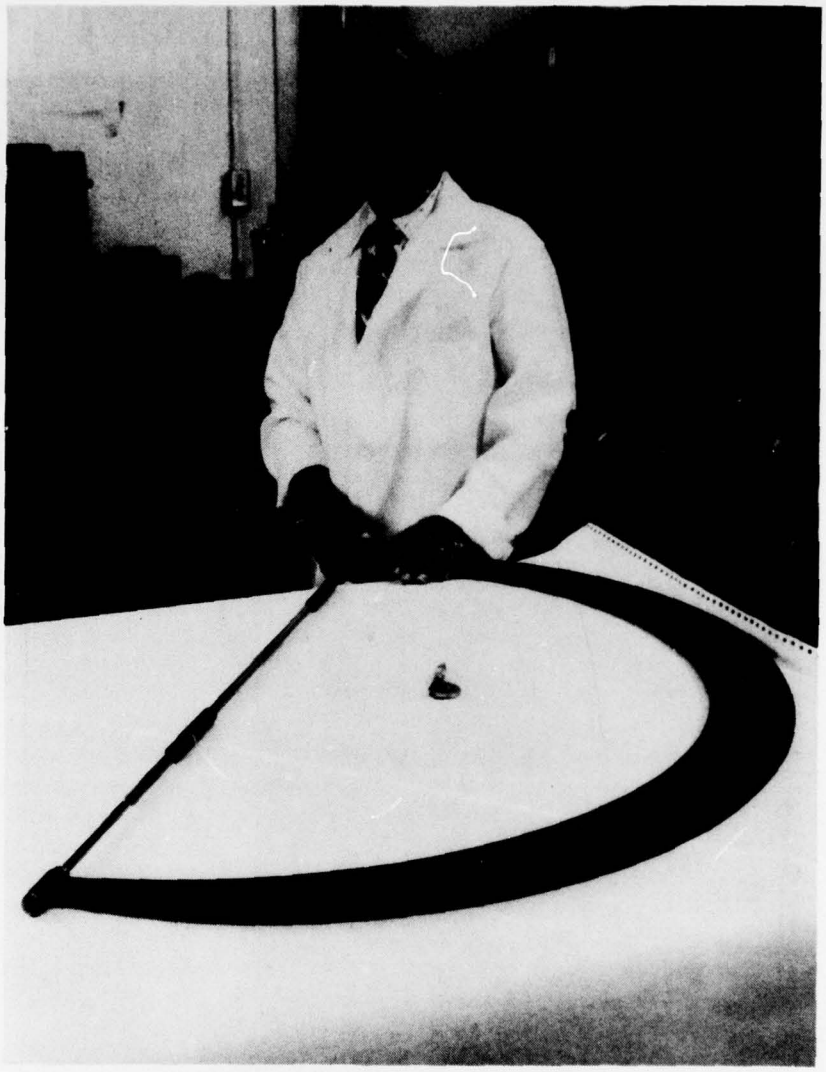
MICROMETERS

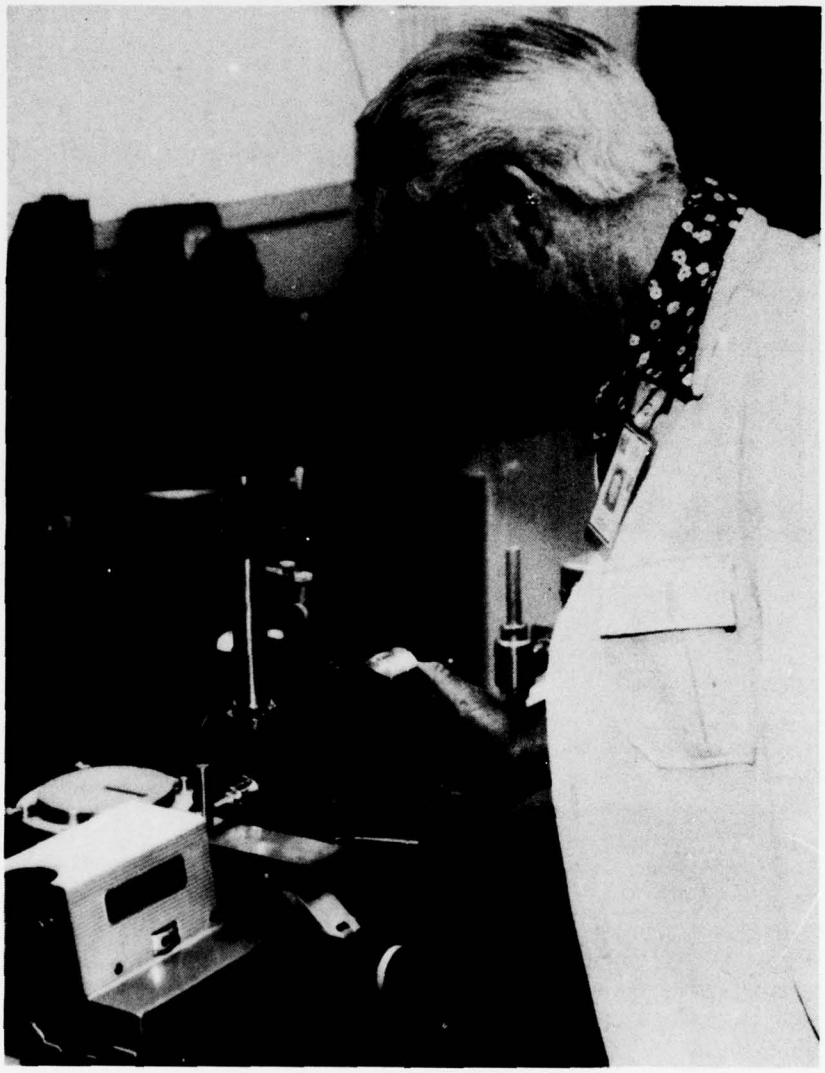
The Metrology Laboratory is equipped with micrometers ranging to 36 inches. Shown being calibrated for zero adjustment is a 36-inch micrometer; a 1/2-inch micrometer is shown on the surface plate.



LRO 4520-7-77

SUPERMICROMETER MEASURING MACHINE

The measuring machine is a precision instrument used to check gages, tools, and parts for diameter, length, roundness, parallelism, and taper to 0.00001 inch. The Electrolimit tailstock has adjustable measuring pressures from 2 to 48 ounces. The photograph shows a 0.500-inch precision gage pin being checked for accuracy.



LHM 2311-3-76

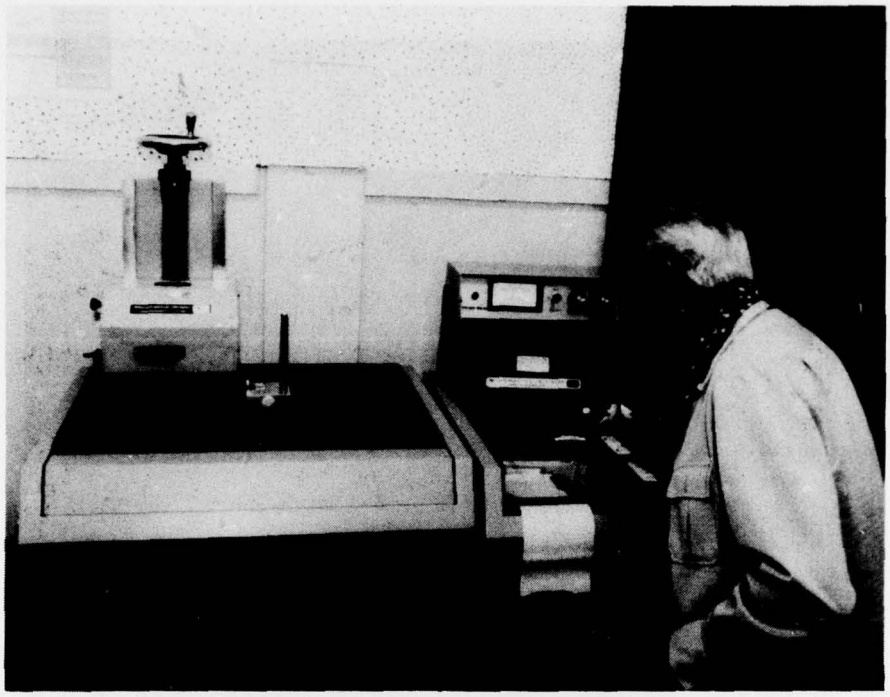
PNEUMOCENTRIC ROUNDNESS GAGE

The Federal pneumocentric is a versatile, highly accurate instrument capable of measuring the roundness, concentricity, flatness, and squareness of any round shape. It fully explores the entire circumference of the part and records all deviations from a true circle. Readout in millionths of an inch is provided. The photograph shows an aluminum housing being checked for roundness.

LHM 2310-3-76

BENDIX PROFICORDER

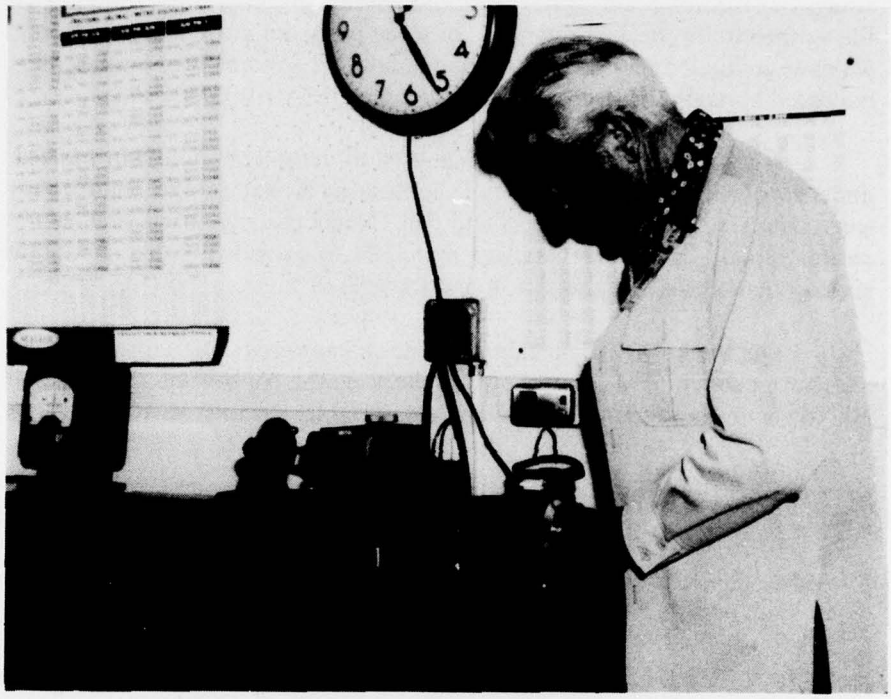
The Proficorder draws a chart that shows the magnified profile of surfaces along a path traced by a stylus. With a straight-line path of trace, the chart shows the microinch height and spacing of waves, bows, steps, flaws, roughness, and other irregularities. The photograph shows an optical holding fixture having the surface finish checked for roughness.



LHM 2309-3-76

ELECTROMECHANICAL LEAD TESTER

The Pratt & Whitney electromechanical lead tester measures straight or tapered threads with an accuracy to 0.000025 inch. The photograph shows a thread gage having the lead error checked for accuracy.



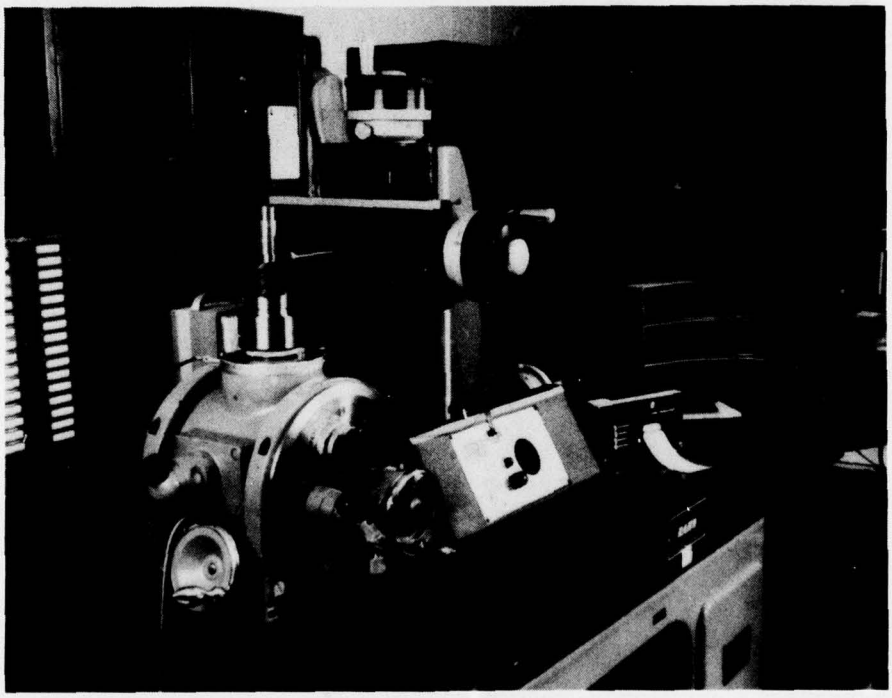
LHM 2314-3-76

X-Y-Z MEASURING MACHINE

The Veeko X-Y-Z is a universal three-axis contour-measuring instrument that provides a fast and accurate method of checking molds, cams, castings, and propellers. The work piece is mounted accurately on a precision rotary table which is graduated to 2 seconds of arc. A probe with either straight or formed point to suit individual need is brought into contact with the surface to be checked by means of three precision movements, each of which is graduated in 0.0001-inch increments. The moment of contact is indicated by audio or visual signals with a sensitivity of 0.0001 inch.

A contoured surface can be checked directly from points or plotted dimensions without resorting to time-consuming layout or slow, cumbersome individual readings by sight and feel. Nonconductive parts such as plaster, wood, plastic, and anodized materials are provided with a conductive coating that adds a thickness of only 0.000050 inch.

The Veeko X-Y-Z machine includes an automatic digital readout in 3 axes with printer. The setup shown is checking the contour of a Torpedo Mk 46 cam mounted on the precision rotary table.



738-2-78B

TOOLMAKER MICROSCOPE

The universal toolmaker microscope will perform linear as well as angular measurements and optically compare contours on finished parts. It thus recommends itself especially for checking thread gages and thread cutting tools, gear cutters, flat and circular form tools, gears, and similar items. The work is illuminated through an understage lighting system and its shadow image is reproduced. This intermediate image and the pattern of the reticule are viewed jointly through a microscope in three selective magnifications. By this unique optical relay system, errors arising from distortion or magnification are definitely eliminated. Linear measurements in two dimensions are obtained by moving the cross slides against micrometers or gage blocks. Angular measurements are provided either by the protractor ocular or the built-in rotary stage. The photograph shows a spline gage being checked for accuracy.

LHM 2312-3-76

ULTRASONIC THICKNESS CALIPER

The Branson ultrasonic thickness caliper is designed for thickness gaging of materials by means of the pulse-echo testing technique. Its operation is nondestructive.

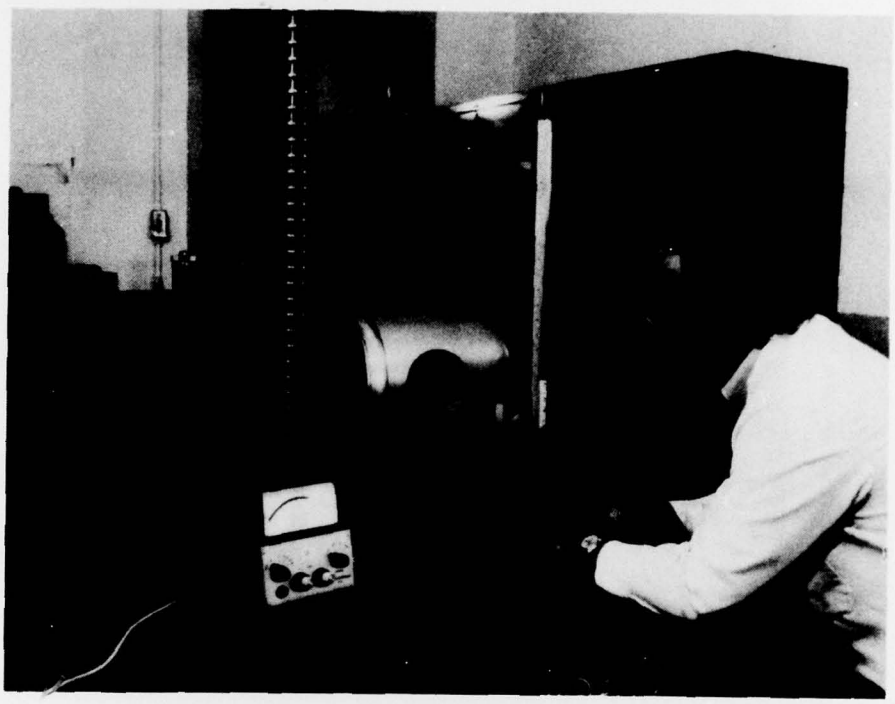
A transducer shell made of aluminum is shown being examined for wall thickness.

LRO 4519-7-77

ROTARY TILT TABLE

The rotary tilt table is used for holding an assortment of work at any desired angle from horizontal to vertical. It can be rotated through 360° in the plane to which it is tilted. The outer edge of the table is graduated in degrees for indexing. Accurate setting is by means of a large dial graduated in minutes, with a vernier which subdivides to 2 seconds. Graduations in degrees on the quadrant face are provided for rough setting of the table in the tilted position. A vernier on this scale subdivides to 1 minute.

A transducer shell is shown being inspected on the rotary tilt table.

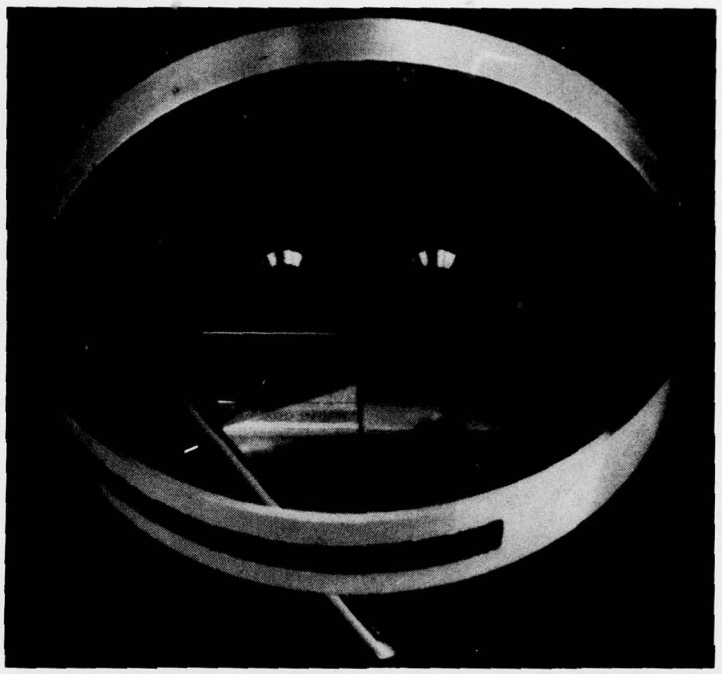


LRO-4518-7-77

OPTICAL FLATS

Measurement by light waves is made with colored or dark interference fringes or bands. Different colors or wavelengths of light result in different measuring units. Daylight has an approximate measuring unit of 10 millionths of an inch per color band. With the monochromatic light, the measuring unit is more precise and amounts to 11.6 millionths of an inch per dark band.

Shown are interference bands on two gage blocks that are being compared for length and parallelism.

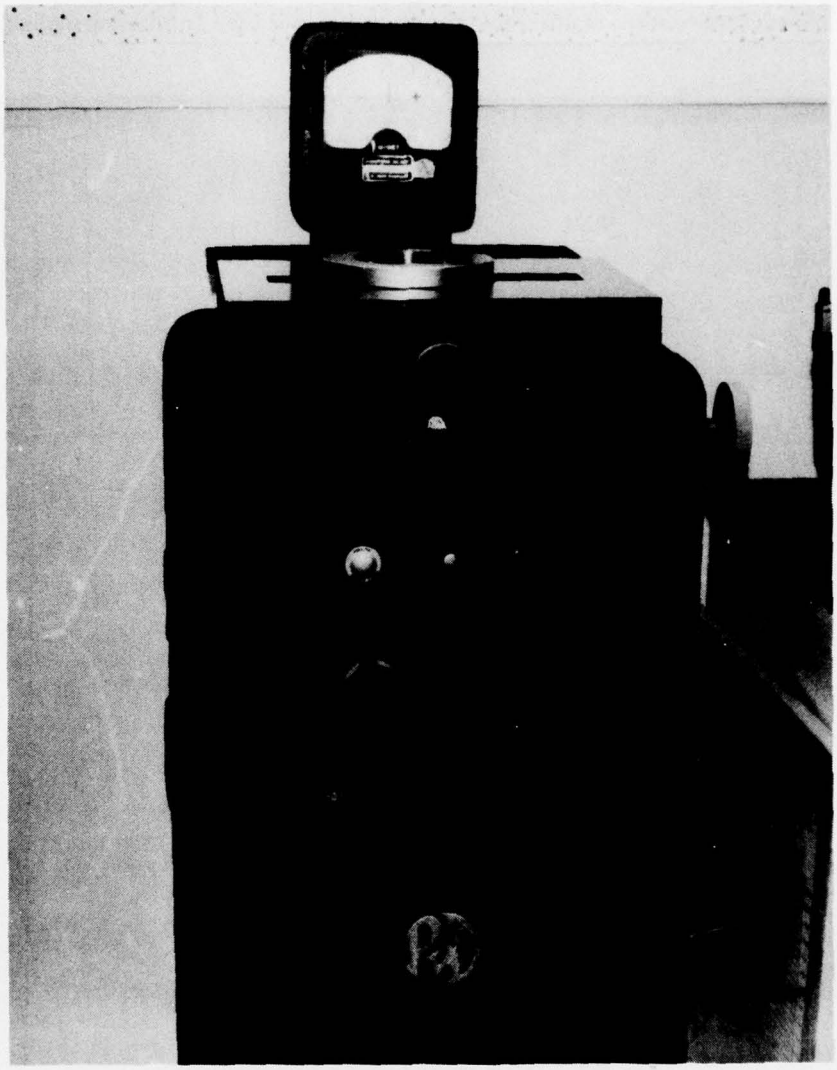


LRO 4523-7-77

LRO-4522-7-77

ELECTROLIMIT INTERNAL COMPARATOR

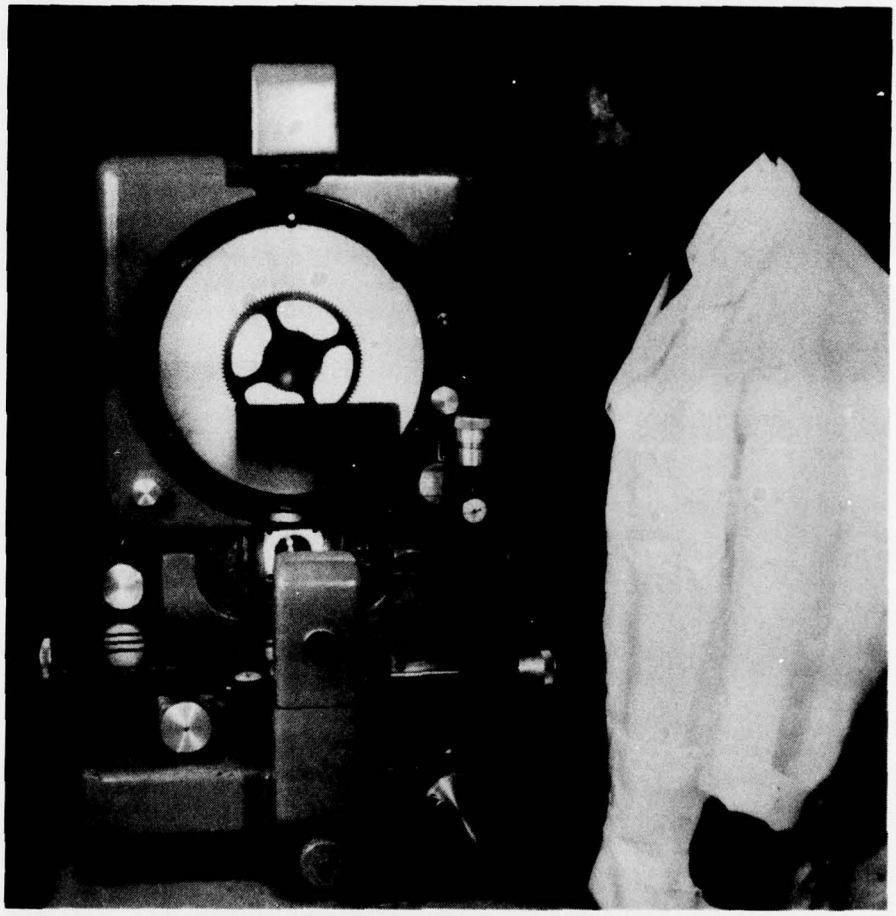
The internal comparator is a two-point adjustable gage with a complete set of interchangeable fixed gaging points to take in all diameters within its range. Because this is a two-point gage it may be set with precision gage blocks as well as cylindrical ring gages. The gage may be readily set to the precise size. The photograph shows a precision ring gage being checked for accuracy.



LHM 2313-3-76

KODAK 14-INCH COMPARATOR

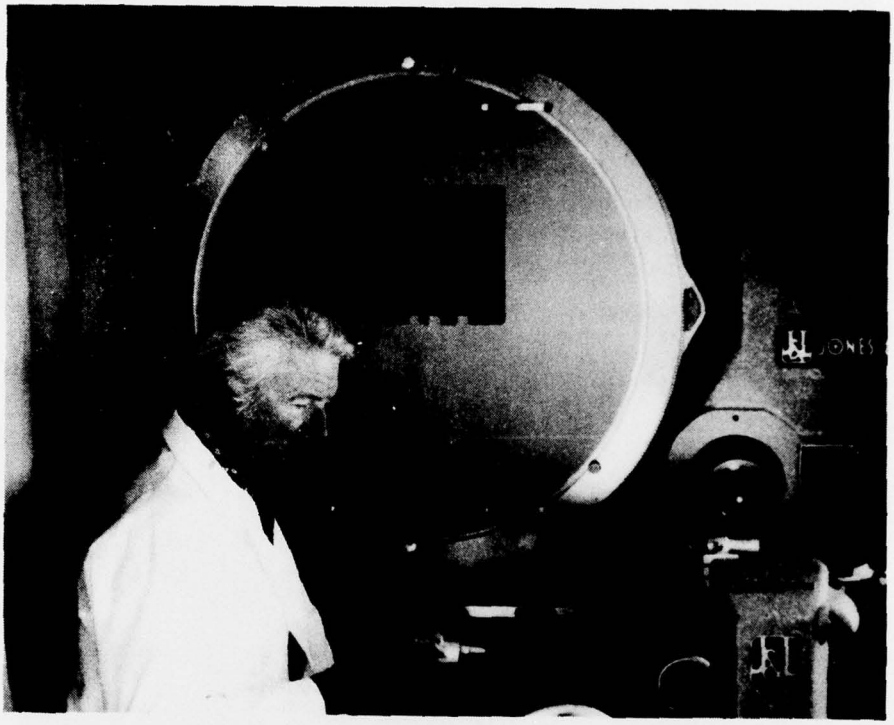
The Kodak 14-inch comparator is a precision measuring instrument for efficiently and accurately gaging a great variety of parts. A shadow outline or a color image of the part (of 10, 20, 50, and 100X magnification) is projected onto a screen at eye level. This image can be measured or compared on the screen. The method used depends on the nature of the job. The worktable can be moved until the projected image of the various dimensional reference points on the workpiece successively coincides with the screen crosslines. These measurements can be read on the micrometer dial at each successive step. A rotatable protractor ring is used for measuring angles.



LRO 4524-7-77

EPIC 30-INCH COMPARATOR

The Epic 30-inch comparator is a precision measuring instrument for efficiently and accurately gaging a great variety of parts. The angle-measuring vernier and graduated chart ring are accurate to 1 minute. The table micrometer is accurate to 0.0001 inch. The vertical measuring dial also is accurate to 0.0001 inch. The photograph shows a Mk 46 torpedo piston being checked for accuracy.

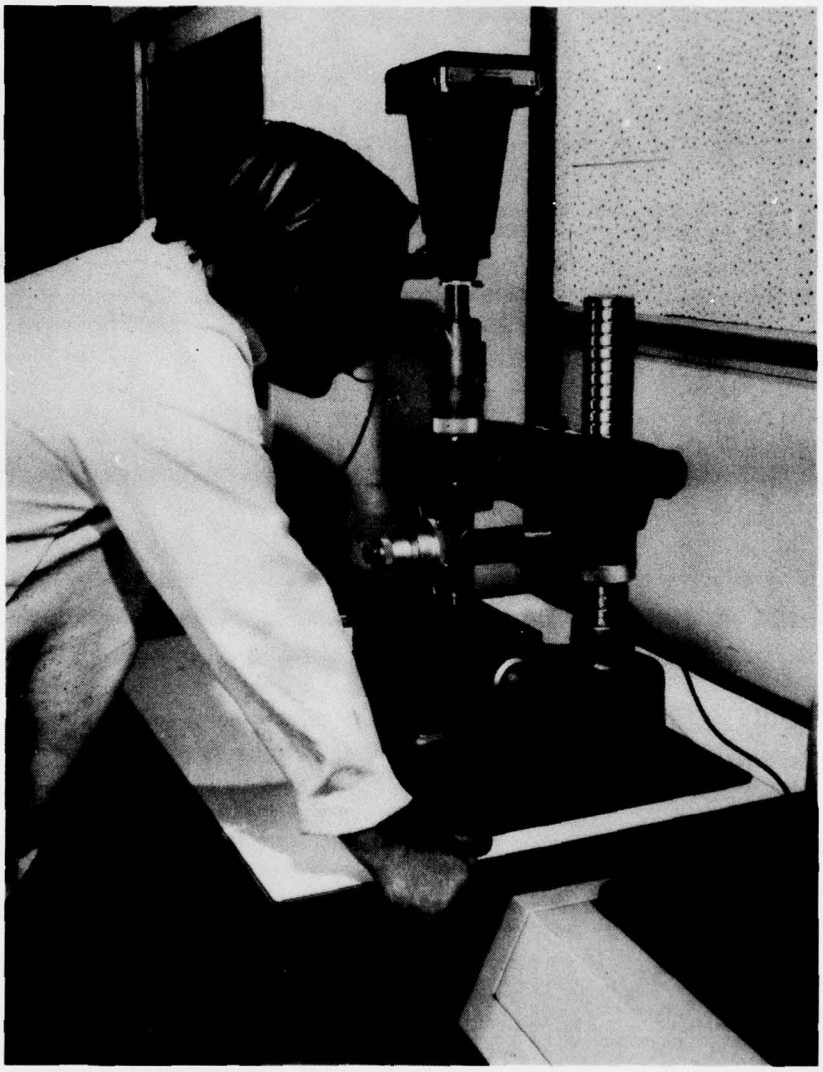


LRO 5413-10-76

REFLECTED LIGHT INTERFERENCE MICROSCOPE

The interference microscope operates on the two-ray principle, and can be used with white or monochromatic light.

A focusing reference mirror, with two ranges of reflection, can be approximated to the reflection of the surface to be tested by means of an adjustment, so that good contrast of the interference bands is ensured. Two lines are engraved in each reflection range of the reference mirror. These lines are included in photographs and are used for direct scale comparisons of surface pictures.



LRO 4525-7-77

AUTOCOLLIMATOR

The autocollimator is a precision optical instrument which utilizes the precise measurement of a small angular deflection of a beam of light. This measurement technique is used when conditions make it inconvenient or impossible to use dial indicators, comparators, or other devices for determination of flatness. The reflected image is highly magnified by a microscope, and its variation in position is measured by a setting-line micrometer which enables small angular tilts to be determined to an accuracy of 0.1 second of arc. This instrument has a range of 10 minutes of arc and reads direct to 0.1 second of arc.

LRO 4521-7-77

SUMMARY OF OTHER MEASURING TOOLS AND EQUIPMENT

The following is a list, by type, of other standard and special measuring tools and equipment available in the Metrology Laboratory:

Blocks, adjustable inspection
Blocks, magnetic "V"
Blocks, "V"
Bore measuring set, Intrimik (to 8 inches)
Calipers, inside
Calipers, outside
Calipers, vernier 0- to 48-inch
Comparator, internal
Comparator, optical 14-inch and 30-inch
Dial indicators
Dividing heads
Drill blanks
Feeler gages
Gage blocks, English and metric systems
Gages, cylinder
Gages, depth
Gages, dial bore
Gages, dial sheet
Gages, groove location
Gages, hole
Gages, planner
Gages, plug
Gages, radius
Gages, scratch depth
Gages, screw pitch
Gages, snap
Gages, surface
Gages, taper
Gages, thickness
Gages, thread ring
Gages, vernier height 0- to 24-inch
Lead checker
Levels, precision
Micrometer, super 0- to 10-inch
Micrometers, blade 0- to 6-inch
Micrometers, depth
Micrometers, disk-type
Micrometers, groove width
Micrometers, indicating
Micrometers, inside
Micrometers, metric
Micrometers, outside 0- to 36-inch
Micrometers, thread
Micrometers, tube

Microscopes
Mirrors, reflection
Optical collimators
Optical flats
Optical square
Optical targets
Parallels, adjustable
Plates, angle
Protractors, bevel
Sine bars
Square, precision
Surface finish analyzers
Surface plates, 24-by-36-inch to 36-by-72-inch
Tape, pi 0- to 36-inch
Telescopes, alignment
Tester, spring
Thread measuring wires
Vernier, gear tooth

The Laboratory also features instruments to check hardness such as Shore durometers, Rockwell hardness testers (superficial and normal), and portable hardness testers.